
DEPARTMENT OF ECONOMICS

# Mixed Oligopoly: Old and New

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## 1 Introduction

Many industries and "sectors" of a modern economy display the interaction of private and public agents which forms the topic of this seminar. A first approximation classification identifies three broad types of situations, which beyond the *prima facie* similarity, are however radically different in origin and nature.

- Traditional goods markets, such as cars, ships or steel manufacturers, or traditional insurers, and so on. A loose generalisation is that these markets started off as fully private markets, and some firms became public at a later stage, that is, they were nationalised. Unlike many of the public utilities, which were nationalised with a view to prevent monopoly suppliers of essential services from exploiting their monopoly power, and where, typically, the entire industry was taken over by the state sector, firms in these industries were nationalised to stop them from going bankrupt,

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which could have labour market, and other economic social and political negative consequences, and therefore, following nationalisation, operated in the same market as the firms which remained private.

- Recent dramatic financial events have brought about the creation of a totally new and utterly unexpected new sector where private and public organisation vie to supply the same customers: several banks in several OECD countries have been effectively nationalised. As history repeats itself, a model often cited is the partial nationalisation of three Swedish banks in the late 1980's (Forsta Sparbanken, Nordbanken, and Gota Bank, which led the government to own over a fifth of the country's banking assets for a brief period). The general consensus seems to be that this situation should be short lived, but given the importance of the sector, it is essential that economic theory provides some understanding of the effects of the interaction among state-owned agents and private suppliers.

- A third group of markets where public and private agents interact are those for goods associated with the welfare state, such as health, education, pension provision, social housing, and so on. These have a longer history of public involvement in provision, though this is far from exclusive. State schools were absent in Europe and in the US at the beginning of the nineteenth century, and widespread one hundred years later, though not necessarily free to all users, and private schools have continued to exist and prosper in most countries alongside public providers of educational services. In the 1880's, under Bismarck's Chancellorship, the German state began to provide accident, health and pension insurance. At the same time, other schemes, like those in Scandinavia, were based largely on the provision of benefits though mutualist arrangements, essentially private in nature. The National Health Service, created in Britain in 1948, nationalised the entire provision of health care, and in the years that followed many other countries, with the notable absence of the US, followed the lead with substantial public sector involvement in health care provision.

In these situations, just like in any environment with different agents, interaction must obey some rules, and the role of a competition authority is to ensure that rules are obeyed. I argue in this paper that in order for the

competition authority to assess the fairness of certain behaviours to ascertain whether or not rules have been broken, it is indispensable to know the objective functions of the agents in the market, and to understand the consequences of the interaction of agents with different objectives. The ownership of a firm or an agency will affect its objective, and different objectives will lead to different behaviours, which in turn might affect differently other firms or agencies in the industry.[1] However, there is nothing intrinsically "right" or "wrong" in having one objective or another. In particular, many agents, both public and private, pursue a different objective from profit maximisation. From a competition policy viewpoint the issue should be whether or not a firm's alleged anti-competitive behaviour is compatible with its objective function. It is only if it is incompatible that allegations of anti-competitive behaviour should be investigated and deterred. Put differently, evidence of anti-competitive behaviour is not tantamount to evidence of anti-competitive intent; the latter is illegal, but the former is not, with the implication that an allegedly anti-competitive behaviour should be prosecuted only if is incompatible with the achievement of the objective function of the public entity in question.[2]

The paper explores the consequences of this argument in the three broad classes of situations illustrated above, and shows that, when private and public agents interact, differences in objective function between them will lead to differences in observed dimensions of performance, often in unexpected and counterintuitive ways.

The paper is organised as follows. Section 2 discusses the well established model of mixed oligopoly, Section 3 sketches a very simple and tentative analytical model for the analysis of the interaction between private and public banks. Section 4 discusses how the interaction between public and private provider of services funded by the state should be organised.

[1] Note that, as a consequence of their interaction, a firm will in general prefer its competitors to have an objective function rather than another.

[2] A football example may clarify the situation. A mid-table team may field a team with many reserve players in the final game of the league for a variety of reasons: if it does so because it has been promised a large payment by the opposition, which needs to win the game to clinch the championship, then the behaviour is illegal. If it does so because it wants to rest some of its first team players in view of the crucial mid-week cup game or because it wants to give some first team experience to its young promising academy players, then the behaviour is perfectly compatible with the spirit of the game. The behaviour may be the same – fielding a weak team –, but the legality of the behaviour must be ascertained in relation to the objectives being pursued through that behaviour.

## 2 Traditional "mixed oligopoly" theory.

Early theoretical interest in the interaction between public and private firms began in the 1980's, at the time when game theory was influencing the analysis of firms with market power. Just as with the interaction between profit maximising firms, counterintuitive results are often obtained. For example, De Fraja and Delbono (1989) showed that, if a public firm may wish to maximise industry welfare, its pursuit of this objective in interaction with private profit maximiser firms will lead it to obtain a greater profit than that obtained by its otherwise identical private competitors.

The archetypal model can be presented in a very simple case (based on Cremer et at 1989).

Consider the market for a homogenous good. The demand function is linear and can be normalised to

$$Q = 1 - p$$

where $Q$ is the total quantity the consumers buy when the price is $p$. There are two firms, one private, one public. They both produce in condition of no fixed costs, and constant marginal and average cost. This is (normalised to) 0 for the private firm, and to $c > 0$ for the public firm. The additional cost reflects the idea that the public firm is less efficient (I'll come the the possible causes for this later). The private firm is a profit-maximiser. The objective function of the public firm is instead the maximisation of the total surplus in the industry, given by the sum of the two firms' profit and the consumers' surplus, defined as the difference between the consumers' total willingness to pay for the quantity of the good they consume and what they actually pay for it. Firms compete in quantity, that is they simultaneously and independently choose the quantity each supplies, and the price adjusts to clear the market.

Let $q_s$ and $q_p$ the quantity produced by the two firms, with subscript $p$ and $s$ mnemonics for "private" and "state-owned". The equilibrium in this market is "Cornout-Nash" namely, it is the simultaneous solution of the following two problems:

$$\max_{q_p} \pi_p = (1 - q_s - q_p)\, q_p \tag{1}$$

$$\max_{q_s} W = (1 - q_s - q_p)\, q_p + (1 - q_s - q_p - c)\, q_s + \frac{(q_s + q_p)^2}{2} \tag{2}$$

(1) is the profit obtained by the private firm. In (2), the first term is the private firms' profit, the second the state-owned firm's profit and the last the

consumers' surplus, measured by the area between the demand curve and the price. The solution, for $c < \frac{1}{2}$ is

$$q_p = c$$
$$q_s = 1 - 2c$$

Which determines a price of $c$. This implies that the state firm produces a quantity such that the market price equals its marginal cost: in the absence of a private competitor, this corresponds exactly to the conditions for maximisation of welfare of a public firm operating in conditions on monopoly (derived long ago by Boiteux 1956). The public firm breaks even (its profit is 0) and the private firm makes a positive profit.[3]

Notice here the possibility of a perception of unfairness: if there were any fixed costs, the public firm would be unable (unlike its private counterpart) to cover them with a positive price-cost margin, and would incur losses which would then need to be funded by the taxpayer.

One drawback of the model is that it does not explain the difference in efficiency between the private and the public firms, but it assumes it exogenously. This appears *ad hoc* and unsatisfactory: what is the source of the different efficiency level? In other words, why can't the public firm copy the technology used by the private firm? This higher slack (or X-inefficiency, Leibenstein 1966) in public firms is sometimes attributed to the fact that they enjoy a soft budget constraint, which allows them to survive even if they incur losses, and protects them from the rigorous discipline of a competitive environment. Public firms, it is claimed, are under pressure to increase employment (Boycko et al 1996), or give a low priority to ability in selecting their employees (Krueger 1990) for political reasons, and this increases their costs. As Vickers and Yarrow (1988) however point out, equally plausible are stories which can justify lower efficiency in a private firm. For example, in wage negotiations with a union, a private firm operating in a noncompetitive environment may also survive with some X-inefficiency, and may have weaker incentive to drive a hard wage bargain, as it does not obtain any additional benefit from building a reputation of toughness to the same extent that the government owner of the public firm would, given that the government will be involved in further

[3] Theoretically, an intriguing feature of this equilibrium is that the two firms behave exactly as they would in a standard duopoly where they compete in price and the marginal cost of the inefficient firm is lower than the industry monopoly price.

wage negotiations with different unions.[4]

To endogenise cost differences suppose that the technology displays increasing returns to scale, at least beyond a certain level of output. To proceed formally, let each firm be able to produce output $q$ at a cost of

$$c(q) = \frac{k}{2}cq^2.$$

Where $c = 1$ for the private firm, and $c \geqslant 1$, for the public firm. Repeating the analysis carried out above for the linear technology, the two firms's output will be the simultaneous solution of the following problems:

$$\max_{q_p} (1 - q_s - q_p) q_p - \frac{k}{2}q_p^2,$$

$$\max_{q_s} (1 - q_s - q_p) q_p + (1 - q_s - q_p) q_s - \frac{k}{2}q_p^2 - \frac{ck}{2}q_s^2 + \frac{(q_s + q_p)^2}{2}.$$

Carrying out the optimisation one gets:

$$q_s = \frac{1+k}{1+k+2ck+ck^2}, \tag{3}$$

$$q_p = \frac{k}{1+k+2ck+ck^2}; \tag{4}$$

which gives a price of

$$ck\frac{1+k}{1+k+2ck+ck^2}, \tag{5}$$

and the these profit levels for the two firms:

$$\pi_p = \frac{1}{2}c^2k^2\frac{2+k}{(1+k+2ck+ck^2)^2}, \tag{6}$$

$$\pi_s = \frac{1}{2}ck\frac{(1+k)^2}{(1+k+2ck+ck^2)^2}. \tag{7}$$

The following are immediate consequences of (3)-(7).

**Corollary 1** *The public firm's marginal cost equals the market price.*

**Corollary 2** *For every value of $c \geqslant 1$, the public firm has a higher output, a higher marginal cost, and a higher average cost than the private firm.*

[4]Difference in efficiency between private and public agencies are attributed to the by Dewatripont et al (1999) to the nature of the objectives, ie whether they are specific or fuzzy and multiple. This tallies well with the observation that public agencies with a clearly specified objective tend to perform better.

**Corollary 3** *If* $c \in \left[1, \frac{(1+k)^2}{k(2+k)}\right)$ *then the public firm's profit is higher than the private firm's.*

According to Corollary 2, any observed higher costs in a public firm need not necessarily be caused by lower efficiency, but may happen even when the two firms used the same underlying technology ($c = 1$) and simply be a consequence of the combination of the facts (i) that public firms produce more and (ii) that this technology has decreasing returns to scale. Corollary 3 extends the previous analysis. The public firm makes *more* profit for itself, even though its objective function is not the maximisation of its own profit. Welfare maximisation makes the public firm very keen to increase output: this leaves a smaller potential market to the private firm (that is a lower residual demand, than it would have if its competitor were another private profit maximising firm. Facing a smaller market, the private firm will restrict output: in the end, even though it can produce more cheaply than the public firm, the lower sales drive its profit below the public firms, unless the cost difference is very high.[5]

The intuition for this surprising result is in fact quite straightforward. It is a consequence solely of the oligopolistic interaction: in condition of monopoly, a public firm will produce to its break-even output level, forgoing monopoly profit in pursuit of lower prices, which are beneficial to consumers. In the presence of competitors, it behaves in the same way: because it benefits more than private firms from an increase in output, the public firm does produce more than the private firms. But because it does not need to produce as much as it would in monopoly condition, it earns the price mark-up over a greater output, even if the mark-up itself is lower, and it makes higher profits, even though it may produce less efficiently.[6] And clearly it does not seem unreasonable for a public firm to try to maximise industry welfare, rather that its own profit. If one takes the view that pursuing an objective in line with the owners' wider goals should not be seen per se as an anticompetitive practice, then welfare maximisation should be a perfectly acceptable goal, just as it is

[5] Note that both firms charge the same price. This is the consequence of the Cournot assumption that they supply identical goods. With product differentiation, public firms charge lower prices. For example Sapienza (2004) find this to be the in the banking market (more on which later).

[6] Of course that a firm which sets out to do something other than maximising profit, may end up making more profit than it would if it had set out to maximise profit is a well known and understood fact in the presence of strategic interaction (Vickers 1985, which build on the seminal insight of Schelling 1960 shows that rewarding managers with a bonus depending on sales is consistent with profit maximisation).

for state schools to provide free education, or for state hospitals to provide free medical care, even though these behaviours also reduce the ability of private institutions to pursue their own objectives.

Notice the crucial role of the objective function: precisely because the public firm wants to maximise welfare, it needs to produce more: any other believable objective which would induce a public firm to increase output beyond what a profit maximiser would do would achieve the same effect. One typical example is the sustainment of employment in industries which are politically or socially considered deserving taxpayer support. A private profit-maximising competitor will be induced to reduce its own output and will therefore see its profit reduced as a consequence of a credible commitment by the public firm to pursue such objective.

## 3 An instructive very simple banking story.

A likely development in the banking industry is that public ownership of banks will be a temporary phenomenon (eg Richardson 2009). Moreover, following the Swedish example, bad debts might be allocated to portions of the banks intended to remain in public ownership for a longer period, with good loans assigned instead to parts of the company to be privatised as soon as possible as separate entities. In this case a strong asymmetry between private and public banks, in addition to their objective function, would remain. But the size of the public sector share and the likely time span of the current industry structure suggest that banking will indeed be a mixed oligopoly at least for a few years.[7] And so the study of a model of which provided insight into the interaction of private and public firms has more than academic interest.

A simple model, contained in De Fraja and Iossa (2009), which isolates the role of the objective function as the sole difference between public and private banks could be the following.

There are two banks and an entrepreneur. The entrepreneur has a project, which can be good or bad. Financing from one of the two banks is necessary for the project to be completed: with no funding the project is not carried out, and everyone's payoff is (normalised to) 0. The payoff to the entrepreneur is always non-negative, and so she wants to always carry out the project irrespective of the value.

[7] In many developing countries co-existence of public and private banks is a long term situation (Andrianova et al 2008).

The entrepreneur chooses one bank (randomly) and asks it for a loan to finance the project. If the loan requested is provided, the entrepreneur runs the project and the game ends. If funding for the project is refused, the entrepreneur goes to the other bank, and again asks it to finance the project. The project is run if it is financed by one bank, and the game ends.

If a project is completed then the profit to the bank is $V_G > 0$, if the project is good and $V_B < 0$ if the project is bad. I assume that the expected value of the project is positive:

$$gV_G + (1-g)\,V_B > 0 \tag{8}$$

where $g$ is the prior probability that the project is good.

A bank can be competent or incompetent. A competent bank observes perfectly the quality of the project, whereas the incompetent bank has no information about it. We begin with the benchmark case where both banks are private, and aim to maximise their own profit.

It is easy to see that the competent bank has an easy choice to make: it finances the project if it is good and it does not if it is bad. The incompetent bank, on the other hand, has a more complicated problem, because it needs to maximise in conditions of uncertainty. For the sake of definiteness, I assume that the second bank knows whether funding for a project has been applied for and rejected. The formulae would be different in the opposite case, but conceptually the analysis would be similar.

**Proposition 1** *If both banks are private, then the first incompetent bank finances the project, the second does not.*

The intuition for this result is the following. Given the behaviour of the first bank, the second bank understands that the only possibility for the project to be refused finance is for it to be bad and for the first bank to be competent. It therefore knows that a rejected project is bad, and reject it itself. The first bank, on the other hand, simply maximises its expected profit, and because (8) holds, it finances the project if it is incompetent.

Now consider the case where one bank is public. As before, it seems natural to posit that the payoff of the private bank is its own profit, the payoff of the public bank is total industry profit, that is the sum of the profit of the private and the public bank (for the sake of simplicity let the profit of the entrepreneur be small, for example because she operate in a competitive market: a richer model, where the entrepreneur's profit is non-negligible, would give

similar qualitative results). Given the very secondary role of the second bank in Proposition 1, the following is not surprising.

**Proposition 2** *Let the first bank approached be the private one. Then the first incompetent bank finances the project, the second never does.*

In Propositions 1 and 2, the probability that a good project is financed is 1, and the probability that a bad project is financed is $(1-\gamma)$. A summary measure of the quality of the organisation of the industry can be given with reference to the following magnitude:

$$gV_G + (1-g)(1-\gamma)V_B \tag{9}$$

The above can be defined as "private oligopoly value of the overall project", and is a different concept from the LHS of (8), in that it embodies the quality of the banks decision making (and so it increases with $g$). Ideally, of course one would wish to finance only good projects, which would give a "private oligopoly value of the overall project" of $gV_G$.

Interestingly, it turns out that the behaviour of the public bank when it is approached first is different depending on the "private oligopoly value of the overall project", (9). To the extent that the value of the project correlates with the business cycle, we can roughly say that if the economy is in an expansion (recession) phase, the "private oligopoly value of the overall project" is high (low). High is defined for parameter combinations such that

$$(1-\gamma)gV_G + (1-g)V_B \geqslant 0 \tag{10}$$

Notice that a project can have a positive expected value (that is (8) holds), and a negative "private oligopoly value of the overall project" (that is (10) is violated). Consider the case in which the first bank approached is the public one. It is useful to distinguish two cases.

**Proposition 3** *Let the first bank approached be the public one, and let (10) be violated (recession). Then neither incompetent bank finances the project.*

Recall that if the first bank is private and incompetent, then it finances the project (Propositions 1 and 2). So Proposition 3 says that the presence of the public bank reduces the probability of financing of a project. In particular, a good project is accepted if either bank is competent, that is with probability

$1-(1-\gamma)^2$. A bad project is never accepted. The value of the overall project in this case is:

$$g\left(1-(1-\gamma)^2\right)V_G \tag{11}$$

Note that (11) is greater than (9) (recall we are in the "recession" case): the presence of the public bank improves the payoff to society because all bad projects are rejected, even if this comes at the cost of rejecting a good project with some positive probability. Since in recession there are few good project rejecting a fraction of them is less costly than accepting some bad projects. The public bank, in a recession, behaves more conservatively than a private bank would in identical circumstances. Note that this stands at odds with what is advocated that public banks should try to increase their lending. Intuitively, the public bank's payoff improves when the second bank is competent, because only good projects are accepted: if the public bank accepted every project (as an incompetent private counterpart would), then the second bank would play no role: it would reject the project if it is asked for finance, and does not consider it if the first bank has financed it. But to the extent that the public bank benefits from the second bank being competent, if the public bank is incompetent it should "delegate" the financing decision to the second firm.

Note that when the second bank is incompetent, it does not finance the project. This is unlike the case where it chooses first, because the fact that it receives the project conveys some information, and affects its belief that the project is good.

**Proposition 4** *Let the first bank approached be the public one, and let (10) hold (expansion). There are three equilibria. In one equilibrium the first incompetent bank finances the project, the second incompetent bank (if called to) does not; in a second equilibrium, the first incompetent bank does not finance the project, the second incompetent bank (if called to) does finance it. In a third equilibrium, both incompetent banks finance the project with probability* $\frac{\frac{1}{1-\gamma}+z}{1+z}$*, where* $z<-\frac{1}{1-\gamma}$ *is* $\frac{g}{1-g}\frac{V_G}{V_B}$.

In each of the three equilibria, the behaviour of both banks is independent of its ownership.

The dry technical description of the equilibria given in the statement invites a more illustrative discussion. Consider the equilibrium where the first incompetent public bank funds the project. This equilibrium is exactly the same as the one with two private banks: the second (private) bank never finances the

project, because it knows that the first bank (either public or private) only rejects bad proposals. The public bank is however more conservative than the private bank, that is it has a higher threshold for funding a project, because it internalises the possibility that it is incompetent.

Consider the converse equilibrium: here the incompetent public bank does not fund the project: because it is possible that the private bank is in fact competent, it lets it decide whether the project should be funded: given the move, the private bank is not pessimist, it understand the strategy followed by the public bank, and knows that a refusal to fund could be due *either* to the bank being competent and knowing that the project is bad, *or* to the bank being incompetent and following its equilibrium strategy. Given the relative probability of these events, if will fund the project if the (10) holds. In both these equilibria, the project is accepted with probability 1 if it is good, and is funded with probability $(1-\gamma)$ if it is bad, exactly the same as in a private oligopoly. In the mixed strategy equilibrium, on the other hand, a good project is funded with probability $\left(1-\left(\frac{\gamma}{1+z}\right)^2\right)g$, and a bad project is funded with probability $\left(1-\left(\frac{\gamma z}{1+z}\right)^2\right)(1-g)$.

While potentially intriguing, mixed strategy equilibria are in this case not fully intuitive, and can be ruled out by an economics argument: the public bank can choose one of the two equilibria as a focal point (eg by announcing that it will be conservative in its lending).

The exact details of the equilibrium aside, this very simple model illustrates again the simple point that the objective function of the public firm affects the behaviour and payoff of all agents in the industry.

# 4 Public-private competition in the welfare state

The industries considered above are traditionally private: in contemporary western societies, public provision in these industries is either a temporary response to an emergency situation, or considered justified on the basis of some special characteristics of the industry where public suppliers operate.

In other sectors of economic activity, public involvement has a wider political acceptance, and is widespread, albeit with remarkable variation from sector to sector and from country to country.

In order to understand this wide variety of modes of public intervention, it is important to separate conceptually *provision* and *funding*, even though

they are often confused by political and media commentators.

1. The service is supplied to final consumers by a state agency, which has the monopoly right to supply.

2. The service is supplied by private profit maximising contractors, either by multiple competing private suppliers, or in monopoly conditions, for example following a competitive auction for the right to be the *ex-post* sole supplier among *ex-ante* competing private suppliers. Typically the buyer is a public agency.

3. The service is supplied by multiple suppliers, not necessarily all private profit maximisers: the price paid by consumers is independent of the type of ownership of the supplier.

4. As in 3, but with the price instead depending on the type of ownership of the supplier.

Essentially all state activities can be classified in one of the above categories. These are some examples.

1. Police protection, national security, defence, crime prosecution.

2. Practically all public procurement, from road building to ancillary services (cleaning hospital, re-cycling, school meals) to PFI in the building and running of prisons, hospitals, schools, and so on.

3. Medical care where patients can use private or public hospitals at the same cost, typically 0; some school voucher systems (where the voucher covers the full cost).

4. Pension provision, housing, and schools (in the absence of a full voucher) are among the examples of this case.

Notice that the pattern of provision varies greatly among these services. Police protection and defence are publicly provided in practically every country. The administration of justice is publicly provided, whereas its necessary counterpart, legal representation, is typically privately provided, even when it is publicly financed through legal aid. On the other hand, there are many services, health and education among them, which are publicly provided in

some countries, almost entirely private in others, and partly publicly partly privately provided in yet other countries.[8]

A common thread among all of these services identified by De Fraja (2008) is the role of human capital in the quality of provision. This is very important for these sectors, and I argue in that paper that the ability of workers in these sectors to deliver a quality much is strongly affected by the interaction with fellow workers while at work: "a doctor will find it easier to perform an operation well or to make a correct diagnosis if her assistants are well trained or if she can readily obtain a second opinion from an experienced colleague. Police officers, teachers, and the military all find the performance of their duties easier [...] if those they cooperate with in the pursuit of criminals, in the classroom, and in the battlefield are 'good colleagues', dedicated, capable and well trained" (De Fraja 2008, p 965). The analysis in that paper highlights that the nature of the human capital externality affects the incentives of public and private providers in a different way, because of their different objectives, and so the two modes of provision may differ in the cost of training, and so the amount of training they provide.[9]

Here I want to argue that the role of training has important implications for the acceptability, from a competition authority's viewpoint, of tax financed subsidies to public suppliers of these services.

In traditional markets public firms must compete "fairly" with private firms. Thus, for example, it is to be assumed that article 87 of the EU treaty, prohibiting "any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens to distort competition by favouring certain undertakings or the production of certain goods" applies to

[8] Note also how the mode of provision has switched quite radically in the course of history: education was originally provided by private tutors and private schools, to be extensively nationalised as it became compulsory; in many western countries the trend now seems to be reversing towards more private provision (while keeping public funding). In Renaissance Italy defence was provided privately: cities did not maintain defence capability, but hired small mercenary armies if and when they needed to engage in wars: the first "modern" publicly financed, publicly provided armies appeared in Europe around the time of the thirty years war (1618-48); before them, armies were feudal in nature, private properties of the local lords. Another example is fire protection: nowadays is publicly provided and funded almost everywhere. In 1791 London, it was provided by three private "Insurance" companies: the first public fire brigade in Britain was established in Edinburgh in as recently as 1824.

[9] And moreover that potentially small changes in the technology of provision could flick the "better" mode of provision from private to public and vice versa, which could be a possible explanation of the differences from country to country and across time in the same country.

state-owned firms as well, effectively constraining the possibility of subsidising the price at which a public firm supplies its customers. Certainly, a state-owned chain of hotels which were to provide below cost services would need to be in exceptional circumstances if it were to avoid challenges by private hoteliers.

And yet private schools, universities or hospitals do not complain about state-owned subsidised suppliers.[10] It is difficult to see that the fact that private schools and hospitals are not-for-profit organisations should be a sufficient reason to justify the difference in treatment: after all a private school will have an objective function, and the difficulty it encounters in recruiting students must inevitably make more difficult for it to achieve its objectives.

I argue here that these differences in the degree of opposition to public subsidies to certain goods for consumers who purchase them from public entities can be explained with reference to the human capital training content of their provision.

To begin to form an intuition for this, let us consider the following goods and services, grouped according to the role and importance of training:

- primary and secondary education, health, tertiary education;
- police protection, defence;
- pension provision and social housing;
- "traditional" state owned enterprises (eg car manufacturers or utilities).

In the first group of services, human capital is a very important input in production. In practice, the training necessary to create human capital is nowadays overwhelmingly provided by public suppliers. Many doctors, after university, train and practice in public hospitals, and, their specialisation completed, may then work in private hospitals. This career path implies that private suppliers do not need to incur the cost of training, a cost which can be substantial, while still enjoying the benefit. Similarly, teachers' training programmes and classroom experience take place mainly in publicly owned schools: it is comparatively rare for teachers to spend their junior years in a

[10] While there are proposals completely to abolish every public intervention into the provision of education, they originate from the right wing fringe of US academic institutions (Lott 1987, McGee 1996), and have never been remotely considered by any US administration, let alone European ones.

private school to move to the state sector for senior jobs; in academia many doctoral students receive a subsidy from governments to study at state universities, and may then go to work for private universities.

In the second group of services, human capital is also very important, and again it is provided chiefly by public sector organisations. As in the first group, there is a considerable spillover from public to private agencies: many airline pilots trained as air-force pilots, and many security guards and consultants are ex-army or ex-police officers. The symmetric career move, from private to public sector providers, is much rarer. But, if human capital side is common to private and public providers, the difference with the services in the first group is on the demand side: the public sector entity operates in a situation of (typically legal) monopoly and therefore the taxpayer's contribution to the cost of their activity does not directly affect private suppliers.

In the third and the fourth groups of services, human capital is a relatively small component of the cost of provision. This might be because the degree of standardisation is quite high or because "on-the-job-training" is less important. Moreover, casual observation suggests that the flow of human capital to and from the private and public sector is not as strongly asymmetric as for the services in the first and second groups.

Theoretically, this identifies a potential externality bestowed by public organisations, and to a different, but no less important, extent by public financing of human capital: a substantial portion of human capital training in health and education is financed by the state sector through university funding, and another important portion of training is acquired on-the-job, by teachers, doctors, nurses and so on who spend some of the working life in state schools and hospitals. Of course there are some workers who join or re-join the public sector after spending some time working for, and accumulating valuable human capital in, the private sector: this is less frequent, and, considering the fact that medical and teacher training is carried out almost exclusively in public hospitals[11] and schools the balance is likely to tip heavily towards the externality going from the public sector to the private sector.

So in these markets the negative output/price externality bestowed by the organisations in the public sector is offset by a positive human capital training externality. A different way of putting is that public organisations produce two outputs: services to students and patients, and human capital training.

[11] US medical schools at private universities are an exception: the cost, however, is carried out by students themselves both in private and in public medical schools.

High output by the public sector implies fewer potential customers for private operators, but higher supply of qualified workers. The former reduces demand for private suppliers, but the latter reduces their costs.

These considerations might explain why private providers in health and education do not typically complain about unfair competition by tax financed suppliers who charge little or nothing for their services.

It is also the case that private suppliers do not complain about public subsidies to services in the third group either: housebuilders and financial intermediaries do not complain about subsidised council housing and state provided old-age pensions. The reason here is not human capital provision, but quality. These goods are usually supplied by the public sector below cost, but only in very low qualities: low income individuals may choose to receive the good in this way, whereas high income households prefer to pay for higher quality (as theorised by Besley and Coate 1991):[12] the objective pursued by the government is redistribution towards low income households. To the extent that the higher end of the market is more profitable, as is empirically the case and as it is predicted by theoretical model (Gabscewitz and Thisse 1979 and Shaked and Sutton 1982) the free supply by public sector agencies is of little concern to profit seeking private suppliers, as they would anyway prefer to supply different segments of the market.

Subsidies for some goods and services may therefore be justified on efficiency ground, to internalise a positive human capital externality, and so that it is and it may be accepted by private suppliers, as they benefit indirectly from it because of a steady availability of trained personnel. But how large should the subsidy be? There is no reason to assume that the optimal subsidy is equal to the cost of production. It will in general depend on the technology and the extent of the externality, and may well be higher or lower than the cost of production. A higher subsidy implies that users are paid to consume the goods. This does happen occasionally. Examples include paying rural children to attend primary school (formally compensating them for lost earnings and

[12] We note that, with incomes growing, the need to provide this services as a redistributive tool also diminishes, in the very long term, somewhat contradicting Alfred Marshall's opinion put in 1893 to the *Royal Commission on the Aged Poor* that state pension provisions 'do not contain ... the seeds of their own disappearance. I am afraid that, if started, they would tend to become perpetual' (Great Britain Parliament. House of Commons (1895), p 543). Privatisation of private housing is another manifestation of the same trend: according to Ginsburgh, "direct provision of affordable rented housing by local authorities is fast disappearing in Britain with the transfer of homes to quasi-private landlords" (2005, p 115).

travel cost, see Behrman et al 2005), paying tanagers from low income households to attend non-compulsory school (Dearden et al 2003, Cardoso and Souza 2003). University tuition fees and co-payment for medical care are examples of a subsidy lower than the cost of production.

An effective way to internalise the human capital externality and at the same time pursue a redistributive objective is through vouchers. At the moment vouchers are used mainly in compulsory education. In its essence, a voucher is a lump sum given to (the parents of) school-age children, which they can use towards the cost of education at a private institution, while state schools remain free to those who choose them: households pay only part of the cost if they choose private education. There is no reason why some form of vouchers could not be used in health or for other goods financed by the public sector.[13] The size of the voucher determines the difference in the price paid by those who choose to use the public and the private service, and it is this difference that should be of concern to a competition authority: the smaller the voucher the more difficult for private supplier to remain in the market and a competition authority may therefore be required to express an opinion as to the size of the voucher, in order to strike a balance between the government's redistributive concern and the benefit of competition.

That a tax financed subsidy to, for example, publicly supplied education is justified by the training externality rather than a redistributive concern, is confirmed by the observation that it is not necessarily the case that quality is lower for the public sector. One would expect that private schools can charge a positive price – and therefore exist– only if they offer better quality than the public school. In practice, whether private schools are "better" than state schools is an empirical point. Surprisingly, relatively few tests have been performed to determine the validity of this conclusion. While Dearden et al (2000, p 21) find that "the impact on educational qualifications of attending [...] a private school is large and significant", De Fraja et al (forthcoming) use the

[13] Paradoxically, the debate about vouchers is hottest in the US, because, in Europe, many schools which would be considered private in the US typically receive public funding in some form or other. In the UK many state school are religious, and are allowed to impose criteria of admission based on the religious attendance of parents schools (many do); until recently, all private school had "assisted places": essentially scholarship paid for out of public funds: while the Labour government elected in 1997 abolished the assisted places scheme, tuition fees at private schools remain VAT exempt, and this reduces the cost to parents, and is, in effect, a voucher. In many countries in continental Europe a substantial proportion of education is privately provided and government funded (see Toma 1996).

same dataset, but account also for children's and parents' effort and find that the effect is mild. Similarly, in a study of Belgium, France, New Zealand, Ontario and the US, Toma (1996) also finds a positive effect of private schools on attainment, but Feinstein and Symons find that "contrary to received wisdom in the UK, attendance at private school is nowhere significant" (1999, p 310). Another UK study, Naylor et al (2002), finds that university graduates who had, prior to university, attended a private school, on average obtain better results at university than graduates who had previously attended a state school (their figure is 3.4% for females and 3.1% for males), but their earnings are not significantly different. An analogous exercise is performed for Italian students by Bertola and Checchi (2001), who, on the contrary, find that attendance of a private school prior to university, *lowers* a student's performance at university.

One of the benefits that justifies the cost to the taxpayer of a voucher scheme is the efficiency enhancing role of competition from private providers, which may not be able to survive if households had to pay for the entire value of the school fees.

Even though this interaction is widespread, and even though there is large body of work that studies the role of competition in "traditional" markets (eg, Vining and Boardman 1992 or Dewenter and Malatesta 2001), or in fully public (quasi-)markets (eg Propper 1996 or Le Grand 1991), evidence investigating the effects of competition between private and public providers in the welfare state is scarce. Shleifer 1998 states that competition has a positive effect on efficiency, even though Propper et al (2004) "find that the relationship between competition and quality of care appears to be negative: greater competition is associated with higher death rates". Similarly Cellini et al find no effect of competition in the Italian health care market. Other evidence on the effects of competition is presented in Dranove and White (1994). An earlier analysis for competition among hospitals, which measured efficiency by mortality rates, found "no statistically significant association between mortality rates among inpatients and either the type of hospital ownership or the number of hospitals competing in the market area"; but demand side pressure given by enrollment in health maintenance organizations does however have a positive effect on efficiency (Shortell and Hughes 1988; related work is Hirth 1999, who studies the role of competition for non-profit agencies).

Coming now to education provision, Brasington (2000) studies quality, and finds that the quality in "public school (...) is responsive to private-school competition but not to competition from other public schools" (p 583). Similar

results are obtained by Couch et al (1993), which however Newmark (1995) and Simon and Lovrich (1996), among others, dispute. An interesting work is Allen and Shen (1999). They consider a private, religious higher education university, and calculate the cross-price elasticities of its demand for admission with the tuition fee charged by three other relevant institutions: a public university located in the same town, a research oriented public university located in the same state, and a private, secular university located in a neighbouring state. The main finding of this paper (which reflects the results obtained by other, older studies, such as McPherson et al 1978) is that public universities do not in fact affect the admission policy of the private university considered. This is attributed by the authors to the large difference in fees between the two types of institutions. The substitutability between institutions is much stronger between private universities. This study is clearly interesting, but, just as clearly, it suffers from the limitation of considering one institution only, and therefore the authors are unable to distinguish from a general causality relationship between fees and admission and the possibility that local effects overwhelm the price effects. The topic is clearly an important one, and, in view of the importance that issue of competition between schools and universities is likely to play in the future, it seems important that more research is carried out.

# 5 Concluding remarks.

Interaction between private and public entities is hugely important, and while the playing field has shifted from traditional firms to providers of public sector services such and health and education, it will clearly be a fundamental feature of developed economies for the foreseeable feature.

I argue here that whether a taxpayer financed subsidy to some suppliers (typically the public ones) is tantamount to "unfair" competition should be assessed with the understanding of the nature of the objective function of the providers: behaviour which would be deemed anti-competitive for a profit maximising oligopolist, may be in line with the objective function of a public, welfare-maximising supplier.

On the other hand, where the presence of public suppliers bestows a positive externality on the private suppliers, for example in the form of the supply of human capital training, then a taxpayer financed subsidy distributed asymmetrically to the players in the sector according to their ownership may benefit

all suppliers, private and public alike. The paper closes highlighting the role of vouchers in providing a subsidy to public suppliers which is less than the cost of supply, whilst maintaining the principle that the users of the publicly provided service receive at no cost.

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